(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 September 2003 (12.09.2003)

PCT

(10) International Publication Number
WO 03/074384 A1

(51) International Patent Classification[7]: B65D 65/40, B32B 29/08, E04C 2/32

(21) International Application Number: PCT/IB03/00832

(22) International Filing Date: 6 March 2003 (06.03.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PA 2002 00347 7 March 2002 (07.03.2002) DK

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
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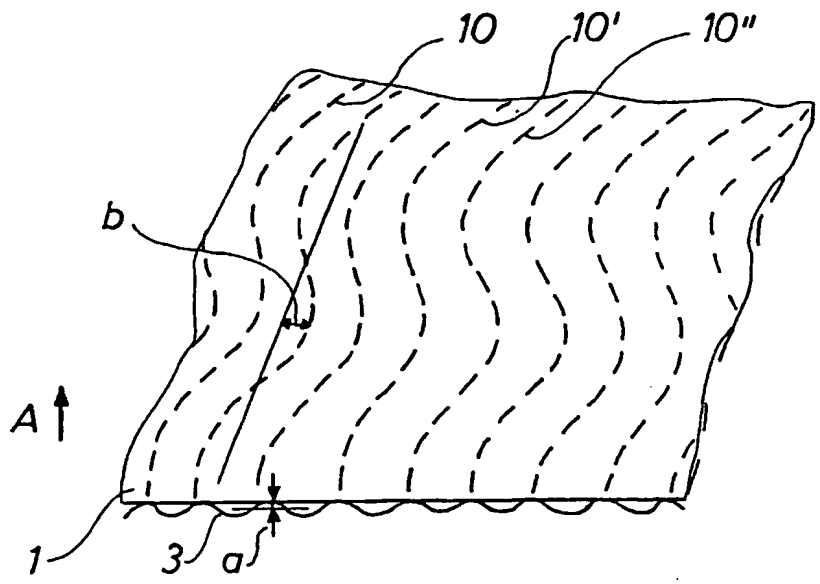
Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A PACKAGING MATERIAL OF THE CORRUGATED CARDBOARD TYPE



(57) Abstract: A packaging material of the corrugated cardboard type includes a laminate of at least one plane paper layer (1) and at least one auxiliary paper layer (3) with waves presenting an amplitude perpendicular to the plane of propagation of the auxiliary paper layer. The two layers are joined by means of a gluing material. The auxiliary paper layer (3) includes furthermore a system of substantially parallel waves (10, 10', 10"), the amplitude of which is in the plane of propagation of the auxiliary paper layer (3). As a result, the packaging material is more stiff than hitherto known without the lightness and voluminocity of the material being affected. In addition, the material possesses an increased tear resistance and is very suited for being provided with prints.

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Title: A packaging material of the corrugated cardboard type

Technical Field.

A packaging material of the corrugated cardboard type which includes a laminate of at least one plane paper layer and at least one auxiliary corrugated paper layer, where the amplitude of the latter is perpendicular to the plane of propagation of the packaging material, and where the layers are joined by means of a gluing material.

Background Art

It is known to manufacture corrugated cardboard which includes a plane paper layer. A corrugated auxiliary paper layer is glued onto the plane paper layer, and the corrugations of said auxiliary paper layer present an amplitude perpendicular to the direction of propagation of the packaging material. All the ridges are arranged as rectilinear parallel corrugations. However, problems are involved in forming folding lines in the material as a folding along a specific line has a tendency to be staggered relative to the adjacent vales. In addition, a printing by means of raster on the plane paper layer implies due to the washboard effect that the printed colours opposite the ridges are of a slightly different tint than the colours opposite the wave. In addition, the tear resistance parallel to the waves is weak. The rigidity of the material and the capability of absorbing impacts of said material are not so good either as said material is not sufficiently stiff.

Brief Description of the Invention

The object of the invention is to provide a packaging material of the above type which is more suited for being subjected to a printing than hitherto known, which is more stiff than hitherto known, and which presents an improved tear resistance.

The packaging material according to the invention is characterised in that the auxiliary paper layer includes a system of substantially parallel waves presenting an amplitude in the plane of propagation of said auxiliary paper layer in addition to the waves presenting an amplitude perpendicular to the direction of propagation of said auxiliary paper layer. As a result, the packaging material becomes more stiff than hitherto known, viz flexurally rigid, without the lightness and voluminocity of the material being affected. In other words, the waves are oscillating in parallel. The folding of such waves requires a considerable force. In addition, the material turned out to be highly suited for imprints. The tear resistance has been increased because the possibility of tearing up the material along a wave has been reduced. The folding lines are very distinct as they always extend across some ridges.

According to the invention, the plane paper layer and the auxiliary paper layer may be of the same thickness, preferably between 0.05 and 0.3 mm, and preferably be approximately 0.1 mm, where the auxiliary paper layer may be of a weight of 50 to 250 g/m^2, especially 70 to 150 g/m^2. The resulting packaging material is very durable.

Moreover, the packaging material may according to the invention include an auxiliary paper layer provided with a plane paper layer on each side, and starch-based glue or cold-water glue may be used for the lamination. Such a packaging material turned out to present a high cohesive power and a long durability.

According to the invention, the surface of the auxiliary paper layer may follow a face substantially corresponding to the functional expression:

$$z(x,y) = a\sin(\frac{2\pi}{\lambda_1}x + \frac{\pi}{2} + b\sin\frac{2\pi}{\lambda_2}y)$$

where a and λ_1 represent the amplitude and the wavelength, respectively, of the waves perpendicular to the plane of propagation of the auxiliary paper layer, and where b and λ_2 represent the amplitude and the wavelength, respectively, of the waves in the plane of said auxiliary paper layer. This embodiment of the packaging material turned out to be particularly suited for transportation of large separate furniture parts and plates.

Moreover, the ratio $\frac{a}{b}$ of the amplitudes for the two types of waves may be in the range of 0.10 to 0.60, preferably 0.15 to 0.50, especially 0.22 corresponding to a = 0.5 mm and b = 2.25 mm. The ratio $\frac{a}{b}$ of the above range rendered it possible to obtain a particularly stiff packaging material in practice.

Furthermore, the ratio $\frac{\lambda_1}{\lambda_2}$ of the wavelengths for the two types of waves may according to the invention be in the range of 0.09 to 0.20, preferably 0.15 corresponding to λ_1 = 3.5 mm and λ_2 = 23.5 mm. This has proved particularly advantageous.

According to the invention, the packaging material may include a plane paper layer, an auxiliary paper layer arranged below said plane paper layer, a second plane paper layer arranged below said auxiliary paper layer, a second auxiliary paper layer arranged below said second plane paper layer and optionally a third plane paper layer. Such a packaging material turned out to be particularly suited for absorbing impacts.

According to the invention the waves presenting an amplitude perpendicular to the direction of propagation of the two auxiliary paper layers may involve a small phase displacement φ between the waves of these layers, preferably of between $\frac{\pi}{4}$ and $\frac{\pi}{3}$.

As a result, the rigidity of the packaging material is additionally increased.

Finally, the waves of at least one type of waves may according to the invention be rather flat on the sides in such a manner that said waves are substantially serrated where the ridges and the grooves are slightly rounded, or the waves may be substantially square. As a result, an inexpensive manufacture of the auxiliary paper layer is obtained because the pressing tools used for pressing the auxiliary paper layer into shape can be manufactured at a lower price than hitherto known.

Brief Description of the Drawing

The invention is explained in detail below with reference to the drawing, in which

Fig. 1 is a perspective view of a first embodiment of the packaging material according to the invention, said packaging material including a plane paper layer and a corrugated auxiliary paper layer arrranged below said plane paper layer,

Fig. 2 is a perspective view of a second embodiment of the packaging material according to the invention, said packaging material including an auxiliary paper layer provided with a plane paper layer on both sides,

Fig. 3 is a graphical view of an XYZ-coordinate system of an ideal embodiment of the waves of the auxiliary paper layer,

Fig. 4 is a perspective view of a portion of a third embodiment of the packaging material according to the invention,

Fig. 5 is a perspective view of a portion of a packaging material according to the invention, where a small phase displacement appears between the waves presenting an amplitude perpendicular to the first auxiliary paper layer and the waves presenting an amplitude perpendicular to the second auxiliary paper layer,

Fig. 6 is a perspective view of a portion of yet another embodiment of the packaging material according to the invention, where the waves of the auxiliary paper layers presenting an amplitude perpendicular to said layers are serrated, viz. triangular waves, and

Fig. 7 is a perspective view of a portion of a further embodiment of the packaging material according to the invention, where the waves presenting an amplitude perpendicular to the direction of propagation of the auxiliary paper layer are square, viz. square waves.

Best Mode for Carrying Out the Invention

The portion of the packaging material shown in Fig. 1 is formed as a laminate including a plane paper layer 1 and an auxiliary paper layer 3. The auxiliary paper layer include waves presenting an amplitude a perpendicular to the plane of propagation of the auxiliary paper layer, viz. follow the direction parallel to the arrow A. However, the auxiliary paper layer includes also a system of substantially parallel waves 10, 10' presenting amplitudes b in the plane of propagation of the auxiliary paper layer 3. The latter waves can also be called oscillating in parallel. The waves 10, 10', 10" are indicated by means of dotted lines because these lines represent the wavy "contact curves" of the auxiliary paper layer 3 relative to the paper layer 1. The contact takes place on the lower face of the paper layer 1.

The plane paper layer 1 and the auxiliary paper layer 3 may be of the same thickness, preferably between 0.05 and 0.3 mm, such as 0.1 mm. Then the auxiliary paper layer can for instance be of a weight of 50 to 250 g/m^2, especially 70 to 150 g/m^2.

As illustrated in Fig. 2, the packaging material can include an auxiliary paper layer 13 provided with a plane paper layer 1' and 1" on both sides. A glue, such as a

starch-based glue or a cold-water glue, can for instance be used for the lamination of the layers.

The surface of the auxiliary paper layer 13 can follow a face substantially corresponding to the mathematical functional expression:

$$z(x,y) = a\sin(\frac{2\pi}{\lambda_1}x + \frac{\pi}{2} + b\sin\frac{2\pi}{\lambda_2}y)$$

where a and λ_1 represent the amplitude and the wavelength, respectively, of the waves perpendicular to the plane of propagation of the auxiliary paper layer 13, and where b and λ_2 represent the amplitude and the wavelength, respectively, of the waves presenting an amplitude in the plane of said auxiliary paper layer 13. The expression applies to a rectilinear XYZ-coordinate system.

The ratio $\frac{a}{b}$ of the amplitudes for the two types of waves can be in the range of 0.10 to 0.60, preferably 0.15 to 0.50, and especially 0.22 corresponding to a = 0.5 mm and b = 2.25 mm.

The ratio $\frac{\lambda_1}{\lambda_2}$ of the wavelengths for the two types of waves can be in the range of 0.09 to 0.20, and preferably be approximately 0.15 corresponding to $\lambda_1 = 3.5$ mm and $\lambda_2 = 23.5$ mm.

Fig. 4 illustrates yet another embodiment of the packaging material which includes a plane paper layer 11, a corrugated auxiliary paper layer 12 arranged below said paper

layer, a second plane paper layer 13a arranged below said auxiliary paper layer 12 and finally a second auxiliary paper layer 14 arranged below said second paper layer and a third paper layer 15 arranged below said second auxiliary paper layer 14, where all the layers are glued together.

As far as the waves are concerned which present an amplitude perpendicular to the direction of propagation of the auxiliary paper layers 12 and 14, a small phase displacement φ can be provided between the waves of these layers, preferably in such a manner that $\frac{\pi}{4} < \varphi < \frac{\pi}{3}$, cf. Fig. 5. Then the plane paper layer 15 corresponding to the paper layer 15 of Fig. 4 has been removed, but nothing prevents said layer 15 from being present.

Fig. 6 shows how a packaging material can include a first plane paper layer 21, an auxiliary paper layer 22 arranged below said first paper layer, a second paper layer 23 arranged below said auxiliary paper layer 22 and a second auxiliary paper layer 24 arranged below said second paper layer 23. In the auxiliary paper layers 22 and 24, at least the waves presenting an amplitude perpendicular to the plane of propagation of the packaging material are provided with rather flat sides in such a manner that said waves are substantially serrated. The serrations can be provided with slightly rounded tops and bottoms, viz. triangularly wavy.

As shown in Fig. 7, it is also possible for the packaging material to include a plane paper layer 31, an auxiliary paper layer 32 and yet another plane paper layer 33. Then the waves presenting the amplitude perpendicular to the plane of propagation of the packaging material are substantially of a square wavy shape.

The packaging material according to the invention are advantageous in disclosing a high flexural rigidity and a high capacity of absorbing impacts. In addition, the mate-

rial presents a high tear resistance because the possibility of tearing up the material along the waves has been highly reduced or eliminated. Furthermore, the material is advantageous in including folding lines which are always distinct because they always continue across the ridges which is an important feature in connection with a mechanical packing of articles. The washboard effect is minimized. Furthermore, the material is very suited for being provided with a graphical print. The material turned out to be particularly suited for packing plane furniture parts. Finally it should be noted that the packaging material according to the invention renders it possible to improve the utilization of the packing machines used.

Each paper layer can, of course, be of a weight in grammes per m^2, which deviates from the weight in grammes per m^2 of each single auxiliary paper layer.

The invention may be modified in many ways without thereby deviating from the scope of the invention.

Claims

1. A packaging material of the corrugated cardboard type which includes a laminate of at least one plane paper layer (1, 1', 1") and at least one auxiliary paper layer (3, 13) with waves presenting an amplitude (a) perpendicular to the plane of propagation of the auxiliary paper layer, and where the layers are joined by means of a gluing material, **characterised in**, that in addition to the waves presenting an amplitude (a) perpendicular to the plane of propagation of said auxiliary paper layer, said auxiliary paper layer (3) also includes a system of substantially parallel waves (10, 10', 10") presenting an amplitude (b) in the plane of propagation of said auxiliary paper layer (13).

2. A packaging material according to claim 1, **characterised in**, that the plane paper layer (1, 1', 1") and the auxiliary paper layer (3, 13) are of the same thickness, preferably between 0.05 and 0.3 mm, such as 0.1 mm, and that the auxiliary paper layer (3) is of a weight of 50 to 250 g/m^2, especially 70 to 150 g/m^2.

3. A packaging material according to claim 1 or 2, **characterised in**, that said material includes an auxiliary paper layer (3, 13) provided with a plane paper layer (1', 1") on both sides, and that starch-based or cold-water glue is used for the lamination.

4. A packaging material according to claim 1, 2 or 3, **characterised in** , that the surface of the auxiliary paper layer (3, 13) follows a face substantially corresponding to the mathematical functional expression:

$$z(x,y) = a\sin\left(\frac{2\pi}{\lambda_1}x + \frac{\pi}{2} + b\sin\frac{2\pi}{\lambda_2}y\right)$$

where a and λ_1 represent the amplitude and the wavelength, respectively, of the waves perpendicular to the plane of propagation of the auxiliary paper layer, and where b and

λ_2 represent the amplitude and the wavelength, respectively, of the waves in the plane of said auxiliary paper layer, viz. the plane of propagation.

5. A packaging material according to one or more of the claims 1 to 4, **characterised in** , that the ratio $\frac{a}{b}$ of the amplitudes for the two types of waves may be in the range of 0.10 to 0.60, preferably 0.15 to 0.50, especially 0.22 corresponding to a = 0.5 mm and b = 2.25 mm.

6. A packaging material according to one or more of the claims 1 to 5, **characterised in**, that the ratio $\frac{\lambda_1}{\lambda_2}$ of the wavelengths for the two types of waves is in the range of 0.09 to 0.20 and preferably is approximately 0.15 corresponding to $\lambda_1 = 3.5$ mm and $\lambda_2 = 23.5$ mm.

7. A packaging material according one or more of the claims 1 to 6, **characterised in**, that it includes a plane paper layer (11), an auxiliary paper layer (12) arranged below said plane paper layer, a second plane paper layer (13a) arranged below said auxiliary paper layer, and a second auxiliary paper layer (14) arranged below said second plane paper layer (13a) and optionally a third plane paper layer (15).

8. A packaging material according to claim 7, **characterised in**, that as far as the waves are concerned which present an amplitude perpendicular to the direction of propagation of the two auxiliary paper layers (12, 14), a small phase displacement φ is provided between the waves of these layers, preferably of between $\frac{\pi}{4}$ and $\frac{\pi}{3}$.

9. A packaging material according claim 1, **characterised in**, that the waves of at

least one type of waves on the auxiliary paper layers are rather flat on the sides in such a manner that the waves are of a substantially serrated (22, 23) shape, viz. triangular waves with tops and bottoms which are optionally slightly rounded, or the waves can be substantially "square" (32), viz. square waves.

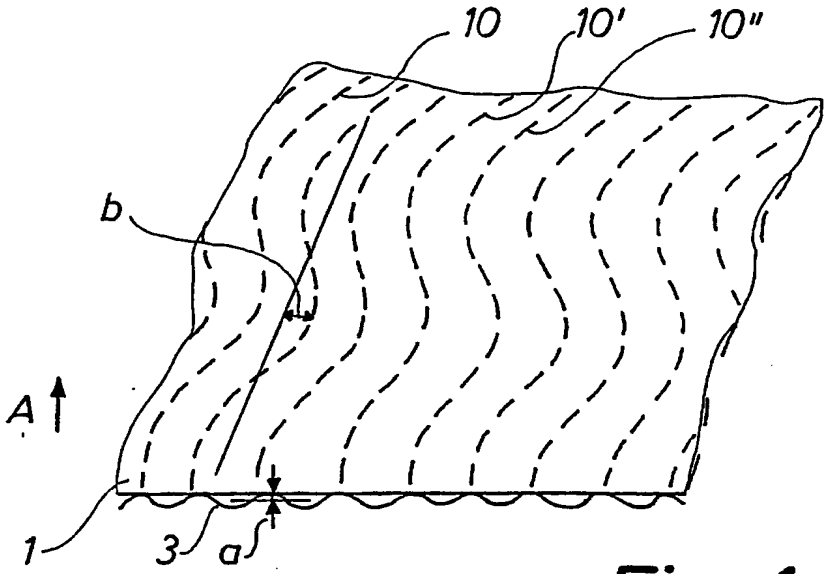

Fig. 1

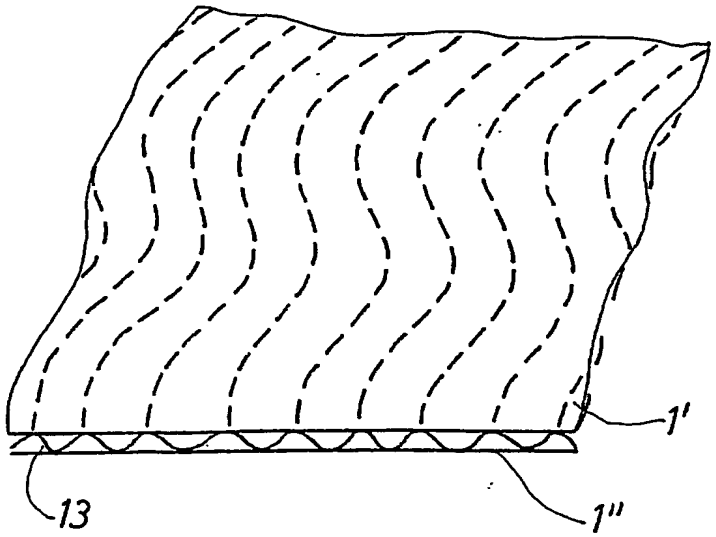

Fig. 2

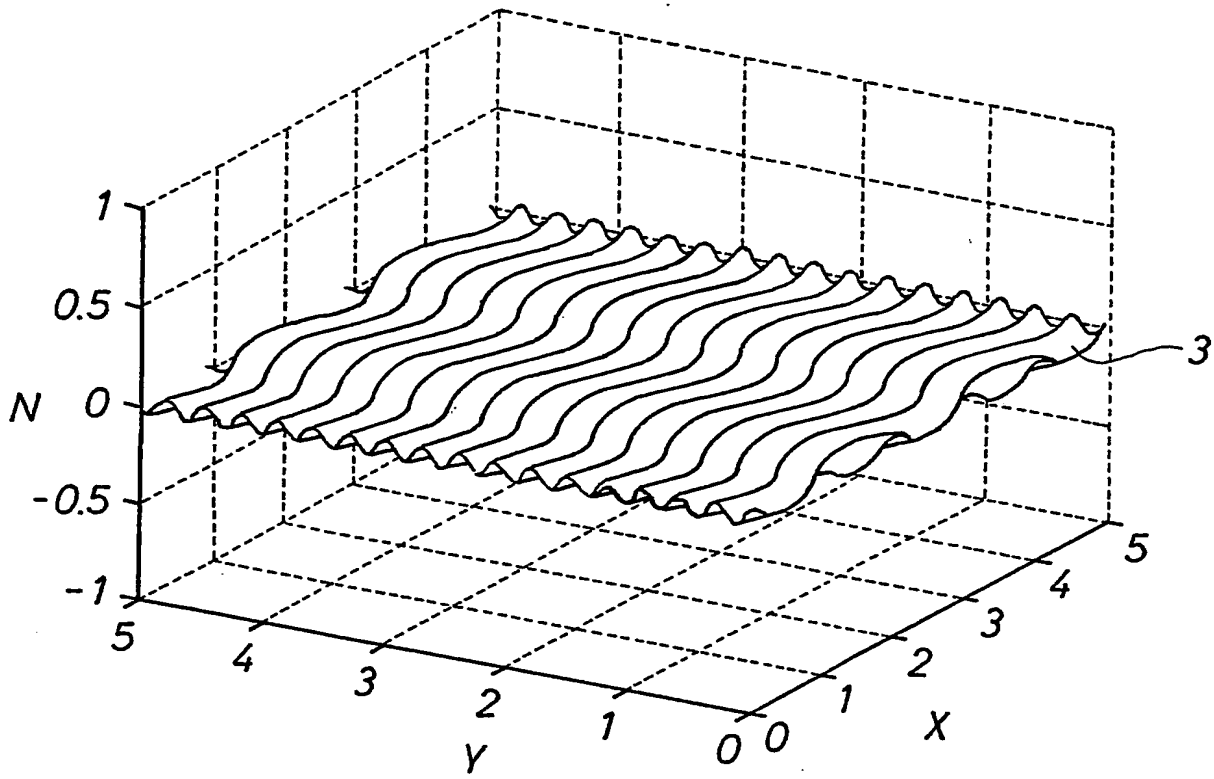

Fig. 3

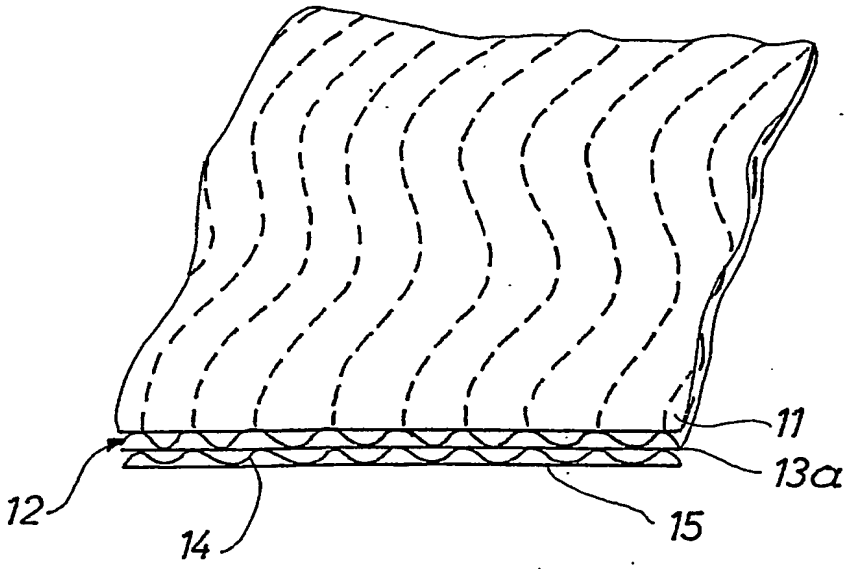

Fig. 4

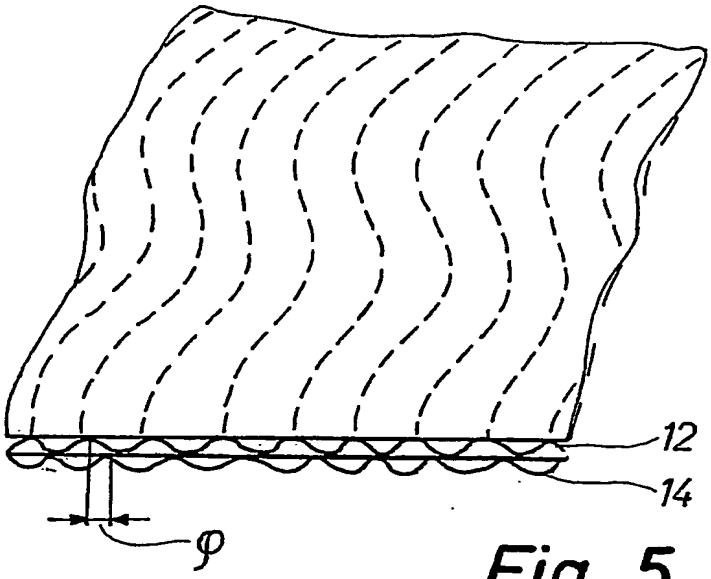

Fig. 5

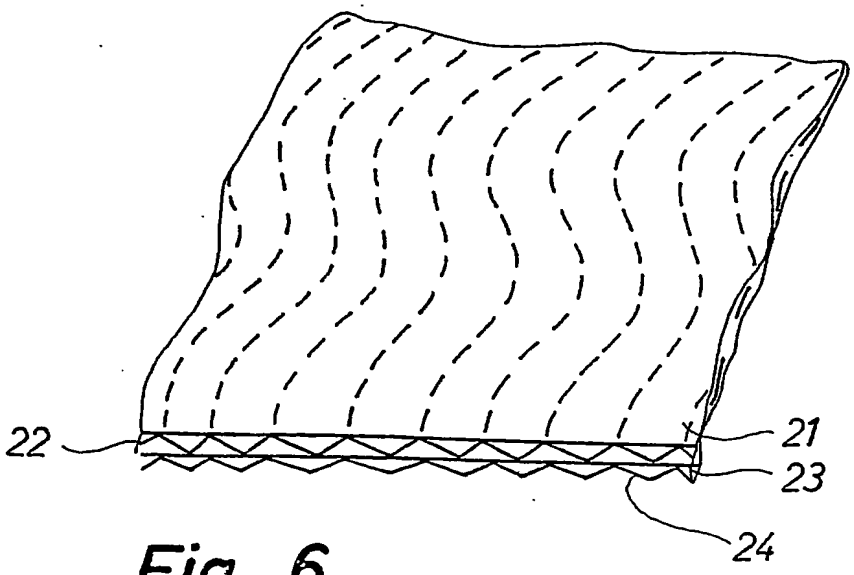

Fig. 6

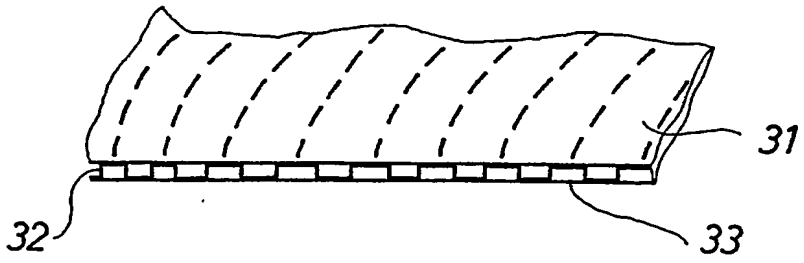

Fig. 7

INTERNATIONAL SEARCH REPORT

Inter[illegible]al Application No
PCT/IB 03/00832

A. CLASSIFICATION OF SUBJECT MAT[illegible]
IPC 7 B65D65/40 B32B29/08 E04C2/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B65D B32B E04C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 424 526 A (ICHIKAWA HIROO) 2 May 1991 (1991-05-02) figures 1,18 ---	1-9
X	WO 00 71277 A (EVANS JONATHAN LESLIE ;BANRO HOLDINGS LTD (GB)) 30 November 2000 (2000-11-30) page 5, line 16 - line 22; figure 9 ---	1-9
A	EP 0 704 380 A (KOLB WELLPAPPE HANS) 3 April 1996 (1996-04-03) column 5, line 33 - line 36; figure 12 ---	1-9
A	US 6 207 242 B1 (HOFFMAN ROGER P) 27 March 2001 (2001-03-27) abstract ---	1-9

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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27 May 2003	25 07 2003

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Inter al Application No
PCT/IB 03/00832

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 615 446 A (LUONG THANH MINH) 25 November 1988 (1988-11-25) page 1, line 17 - line 30; figure 1 -----	1-9

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